

Ostomy-Related Complications

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Abstract

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Ileostomy or colostomy formation is an important component of many surgical procedures performed for a wide range of disorders of the gastrointestinal tract. Despite the frequency with which intestinal stomas are created, stoma-related complications remain common and are associated with significant morbidity as well as cost. Some of the most prevalent complications of stoma formation which will be detailed in this article include peristomal skin complications, retraction, stomal necrosis, stomal stenosis, prolapse, bleeding, dehydration from high ostomy output, and parastomal hernia. The authors will review these common complications, detail means to avoid or prevent them, and outline recommendations for management.

More than 100,000 stomas are created each year in the United States.¹ Temporary, or permanent, ileostomy or colostomy creation is utilized in the management of a variety of benign and malignant medical conditions including, but not limited to, inflammatory bowel disease, gastrointestinal malignancy, gastrointestinal obstruction or perforation including anastomotic leak, trauma, severe perineal wounds requiring diversion, end-stage incontinence, and others. Regardless of stoma type, with proper construction technique, stoma care, and psychosocial adaptation, ostomies should minimally limit and will often improve the quality of life of the patient.² The exact type of stoma and its anatomic location within the gastrointestinal tract and on the abdominal wall can have implications in terms of the associated complication profile and ensuing management strategies. Complications related to stomas can be minor and managed effectively with local enterostomal therapy, or can be devastating, requiring reoperation and burdening the mental and physical well-being of the patient and the health care system.³

The reported incidence of stomal complications ranges from 21 to 70%. While the risk of developing a complication remains lifelong, the incidence is highest in the first 5 years after stoma formation.^{1,4,5} Complications can be temporally divided into those that occur within days of surgery (immediately in the postoperative course) and are most often technical in nature, those that occur within the first month of surgery (early in the

postoperative course) and are usually related to suboptimal ostomy site selection, and those that occur late and are commonly seen in the setting of permanent stomas. In general, end ostomies, either ileostomies or colostomies, are associated with lower complications rates than loop ostomies, and loop colostomies, in particular, are associated with the highest complication rates.¹ While the most commonly reported ostomy-related complication overall is peristomal skin breakdown secondary to leakage, other common complications that will be detailed include retraction, stomal necrosis, stomal stenosis, prolapse, bleeding, dehydration from high ostomy output, and parastomal hernia. Stomas can also be associated with small or large bowel obstruction, peristomal abscess, fistula, or pyoderma gangrenosum, although these will not be detailed in this article.

Whenever possible, patient education and preparation for life with an ostomy should begin in the preoperative period. It has been well established that both involvement in ostomy support groups and counseling by certified wound ostomy continence nurses (CWCNs) can reduce complication rates and improve long-term outcomes and psychosocial adjustment.^{6,7} In an era of increased reliance on enhanced recovery after surgery (ERAS) protocols and shorter postoperative hospital stays, maximizing patient preparation and education preoperatively is imperative.³ In addition, regardless of indication or ostomy type, preoperative stoma site marking by

enterostomal therapists or experienced surgeons has been shown to reduce the incidence of postoperative complications.^{1,8} It is widely agreed that suboptimal stoma site location is a leading risk factor for the development of many of the most common postoperative stoma-related complications. Unfavorable stoma site location is associated with poor fit, leakage, skin irritation, trauma, and poor visualization of the stoma itself—all of which lead to psychological distress and difficulty with stoma care and postoperative adjustment.^{3,9} Suboptimal stoma site location is seen more frequently in the setting of emergency surgery. In the emergency setting, up to 37% of patients who receive an ostomy are not stoma sited preoperatively. This highlights the need for involvement of CWOCNs or preoperative marking by an experienced surgeon even in more time sensitive circumstances.^{3,5,10} Other global risk factors for ostomy complications include surgeon experience and specialization, a nonprotruding stoma (stoma height <1 cm), obesity, smoking, diabetes, and inflammatory bowel disease.^{10–12}

Technical Considerations

Quality-of-life studies have established a correlation between ostomy function and patient satisfaction.¹³ This underscores the importance of preoperative planning and attention to technical detail in constructing a high-quality stoma to decrease the incidence of stoma-related complications.

Choosing a proper stoma site should be done preoperatively whenever possible. To identify issues with body habitus, the patient should be examined for marking while lying supine, sitting, and standing. Patient preferences or disabilities should also be taken into consideration when marking a stoma site. Whenever possible, the anticipated stoma site should be remote from bony prominences, planned incisions, old incisions, and skin creases. A surrounding 2-inch flat area of healthy skin helps ensure adequate appliance seal. Stoma sites should be placed at the apex of a fat mound where possible. In the obese patient, the patient with otherwise difficult anatomy (prior scars), and especially when operative plans are not certain, multiple sites should be marked.³

Purely technical errors in stoma creation such as utilizing the wrong segment of bowel or maturing the wrong limb are rare events. When in doubt, serosal marking can be used to delineate the proximal limb to remove any confusion. Insufflation through the rectum can also help the surgeon to distinguish the sigmoid colon from more proximal colon and to orient the surgeon to proximal and distal limbs when needed.³ While creation of a well-vascularized, tension-free, widely patent stoma of adequate length can be straightforward, the surgeon must be prepared for more challenging circumstances including emergent surgery and the obese patient with a thick abdominal wall or foreshortened thickened mesentery.¹⁴

Although a detailed discussion of the importance of preoperative planning, patient preparation for the psychosocial stresses of having an ostomy and other aspects of the technical details of ideal stoma construction are beyond the scope of this article, their importance cannot be underestimated.

Peristomal Skin Complications

Peristomal skin complications can arise from a multitude of factors including chemical injury from leakage of stoma effluent, mucocutaneous separation, and trauma and mechanical injury from adhesive stripping from repeated appliance application, contact dermatitis, infection, or pyoderma gangrenosum (—Fig. 1). Additionally, these complications are frequently encountered in patients with other stoma-related complications such as prolapse, retraction, and parastomal hernia. Peristomal skin complications in aggregate occur with a reported incidence of up to 43%, and they are more commonly seen in patients with ileostomies.¹⁵ Frequently, they can be managed with the involvement of clinical ostomy nurse specialists and conservative measures such as utilization of skin barrier rings to adjust the pouching system to improve the appliance seal, topical therapy to protect the skin and promote healing, as well as utilization of convex appliances to enhance stomal protrusion and improve the seal. Thus, these problems are not always brought to the attention of the surgeon and therefore may be underreported.³ Nonetheless, the economic impact of peristomal skin complications is profound. Taneja et al reported that total health care charges are more than \$78,000, higher in patients experiencing peristomal skin complications than those without.¹⁶ The most important thing that the surgeon can do to minimize these complications is to create a protuberant ileostomy of 2 to 3 cm that minimizes direct contact of the effluent with the skin.¹⁷ Even colostomies should be protuberant as those that are less than 1 cm in height in the immediate postoperative period are associated with 35% incidence of peristomal complications.¹⁸ When peristomal skin complications persist due to poor stoma siting or improper stoma construction, then consideration should be given to reversal of temporary stomas and surgical revision or resiting of permanent stomas.

Mucocutaneous separation, the dissociation of the ostomy from the surrounding peristomal skin, occurs to some degree in up to 28% of patients in the immediate postoperative period. It is frequently a technical complication secondary to excessive tension, although it can also arise from infection or factors that impair wound healing such as the excessive use of cautery on the skin or bowel mucosa, immunosuppression, or diabetes.⁹ The magnitude of the separation and resultant management strategy varies; small separations can be managed with absorptive filling materials such as skin barrier powder or coverage with the ostomy appliance wafer. Early detection and aggressive wound care are vital. Larger or circumferential dehiscence may require operative revision to prevent longer term complications such as retraction or stenosis.^{10,15} It is important to note that in certain clinical scenarios, such as in the morbidly obese patient or when anatomic bowel factors mandate, suboptimal stomal construction may be unavoidable. As long as the stoma remains viable above the fascial level, definitive management of stomal complications must come secondary to clinical stability and should be delayed as long as possible to allow for bowel lengthening which may afford the opportunity for successful revision.



Fig. 1 Pictures of common stoma complications. Clockwise from the top left: mucocutaneous separation, peristomal contact dermatitis, stoma stenosis, and stoma necrosis.

Retraction

Stomal retraction, commonly defined as a stoma that terminates > 0.5 cm below the skin surface within 6 weeks of formation, occurs in up to 14% of new stomas in the early postoperative period.^{4,18} Retraction is often associated with additional complications including leakage and peristomal skin irritation, mucocutaneous separation (►Fig. 1), and peristomal abscess.³ The most common cause is excessive tension on the stoma, usually secondary to inadequate mobilization of the intestine especially in the case of sigmoid or descending colostomies matured without full mobilization of the splenic flexure.¹⁷ Therefore, early attempts at local revision are often futile; after a significant period of time, often 3 to 6 months or more, autologous mesenteric lengthening may allow for successful local revision. Additional risk factors include obesity, postoperative weight gain, a foreshortened mesentery as can be seen with Crohn's disease, initial stoma height < 1 cm, malnourishment, or immunosuppression. In many cases, this complication can be prevented with attention to the technical construction of the ostomy, including adequate mobilization of the mesentery and creation of an appropriately sized fascial opening. In the setting of the obese patient with a long subcutaneous fat length or excessively thick conduit mesen-

tery, small wound protractors may be placed at the stoma site and lubricated with water or a water-based lubricant to aid in the delivery of a thickened bowel segment through the abdominal wall while simultaneously compressing subcutaneous tissue and stretching the stoma trephine. In the setting of loop stomas, many surgeons use sustaining rods, or stoma bars, to reduce the incidence of retraction. Although a fairly ubiquitous practice, Zindel et al reported no difference in retraction rate between patients who received a stoma rod and those who did not, but they found a significantly increased risk of stoma necrosis in the rod group.¹⁹

Retracted stomas with an intact mucocutaneous junction can initially be managed with convex appliance systems that flatten the peristomal skin to increase the surface area of the appliance to skin interface. Additional ostomy accessories including belts and binders can also be used. If leaking and hygiene issues persist despite these measures, or if there is concomitant stenosis, then surgical revision must be considered.¹⁸

Stomal Necrosis

Stomal necrosis has been reported to occur in up to 20% of ostomates in the immediate postoperative period (►Fig. 1).³ Specific risk factors for stoma necrosis include emergent

operation, inadequate mobilization of the bowel, excessive mesenteric resection resulting in inadequate arterial blood supply to or venous drainage from the bowel, and constriction in the abdominal wall due to excessively small openings in the fascia, abdominal wall mesh, or skin.^{10,20} Importantly, the obese patient is seven times more likely to experience stoma necrosis than the nonobese patient.²¹ Stoma necrosis is much less common for loop stomas given the dual blood supply to both the afferent and efferent limbs.

Assessment for possible ischemia should always take place before leaving the operating room, and if there is concern, the stoma should be revised at the initial operation. To aid this, the segment of bowel to be used for stoma formation should be prepared as early on in the operation as possible to allow maximum time for any ischemic demarcation to declare itself.³ Excessive trimming of peri-intestinal fat and the mesentery should be avoided. Despite attention to these details in the operating room, stomas can often appear dusky in the immediate postoperative period. One must distinguish whether this appearance is on the basis of venous congestion, which usually improves as postoperative edema subsides, or arterial insufficiency. If there is suspicion for stomal necrosis secondary to inadequate arterial blood supply, it is imperative to delineate the extent with a flexible pediatric endoscope, proctoscope, or even a clear test tube. If necrosis extends below the level of the abdominal wall fascia, then immediate surgical revision with a laparotomy is required. If the necrosis is limited to the intestine distal to the abdominal wall fascia than observation with gentle debridement or expectant management can safely be considered, although this management strategy can ultimately result in longer term complications such as retraction or stenosis. Still, stoma revision is often technically much easier months removed from the index operation when early intense inflammatory adhesions and bowel/mesenteric edema have subsided.⁴

Stomal Stenosis

Clinically significant stomal stenosis occurs with an incidence of 2 to 15% and is most commonly seen with end colostomy (► **Fig. 1**). Stenosis in the immediate postoperative period often occurs secondary to small trephine size or bowel edema and can often be managed with decompression with large bore rubber catheters. Late stenosis can result from several causes including poor surgical technique resulting in an ischemic stricture, peristomal abscess, recurrent disease (Crohn's disease), or malignancy. Early mucocutaneous separation and retraction frequently result in stomal stenosis due to the effects of secondary wound healing and contracture.⁴ While mild stenosis can often be managed with serial gentle dilation, local revision with creation of a new tension-free stoma is needed with more severe stenoses and those associated with inflammatory bowel disease or ischemia.

Prolapse

Classic stomal prolapse is a full-thickness telescoping of the bowel through a stoma. While this can occur with any type of ostomy, it is more common with colostomies than ileostomies,

and in particular, with loop colostomies of the transverse colon where it occurs with an incidence of 7 to 26%. It is the efferent (distal) limb which is most often involved in prolapse of a loop stoma. Stoma prolapse is a late complication of stoma formation. Risk factors for prolapse formation include advanced age, obesity, abdominal wall laxity, a large fascial opening, bowel obstruction at the time of stoma creation, redundant or mobile bowel proximal to the stoma, and conditions that increase intra-abdominal pressure such as chronic cough, ascites, or constipation.¹ Maeda et al have described alternative techniques for stoma construct to prevent prolapse, but there is no high-level data supporting these approaches.²² Additional studies have failed to demonstrate a reduction in incidence of prolapse with mesenteric or fascial fixation at the time of stoma creation.^{3,22}

In mild forms, prolapse may cause issues with appliance placement and seal quality resulting in leakage or psychological distress. Acute prolapse can often be managed by gentle bedside reduction, often with the aid of osmotic agents such as table sugar to reduce the bowel wall edema.²³ Stoma accessories such as binders can help prevent recurrent prolapse of reduced bowel, or elective repair can be pursued. More severe or chronic prolapse can be associated with incarceration and strangulation of the intestine with the consequent ischemic changes requiring resection and revision or relocation of the stoma. Fortunately, this is a rare event. It should be emphasized that when appropriate reversal of a temporary stoma with restoration of intestinal continuity is the ideal surgical option for stoma prolapse and most other stoma-related complications.⁴

Bleeding

The incidence of stomal bleeding is not known, in part because this complication can occur immediately, early, or late after stoma formation. It most commonly results from abrasive trauma to the stoma, usually secondary to a poorly fitting too tight appliance. This type of bleeding can be managed with direct pressure, mucosal cauterization, or suturing of identifiable vessels. More significant stomal bleeding can be seen in the setting of peristomal varices. These develop in patients with portal hypertension of any cause. While bleeding can initially be managed with direct pressure or suture ligation, reducing portal pressures with medical therapy or transjugular intrahepatic portosystemic shunting is imperative to reduce the risk of recurrent bleeding.²⁴ In emergency cases of severe variceal bleeding, stomal disconnection and reanastomosis can provide a temporary solution.

Fluid and Electrolyte Imbalances from the High Output Enterostomy

While peristomal skin complications are the most common complication for new ostomates, dehydration from high-volume output is the most common cause of readmission in the early postoperative period, with readmission rates reaching 17% for dehydration alone.¹⁵ This is even more common in patients who have undergone a restorative

proctectomy with an ileal pouch due to the more proximal location of the stoma in the ileum. Readmission for dehydration is associated with later, longer, and repeated readmission.²⁵ It is not only readmissions which are of concern but also ileostomy creation has been shown to be associated with acute kidney injury-related hospital admissions and increased risk of developing severe chronic kidney disease.²⁶

Studies suggest that new ileostomates are at the highest risk of clinical dehydration in the first 3 to 8 days postoperatively as effluent output slowly stabilizes and becomes more solid. Careful attention must be paid to fluid balance and fluid replacement during this time as patients frequently have already been discharged from the hospital.²⁷ Glucose-electrolyte balanced drinks should be used to avoid hyponatremia.³ In the longer term, increases in serum aldosterone levels described as “ileostomy adaptation” help mitigate the effects of salt and water depletion.²⁸

Prior to index discharge from the hospital, patients with new stomas, especially those with ileostomies, require dietary education that emphasizes salt and water balance and consumption of smaller, more frequent meals. In addition, they must demonstrate proficiency with emptying and changing their appliances and recording the output. In the era of ERAS pathways, patients are most often discharged from the hospital before their ileostomies have fully adapted in terms of salt and water reabsorption. It is important that they understand and monitor for signs and symptoms of dehydration and are able to take action if needed to minimize the effects of dehydration.

Even with the dedicated work of CWOCNs and other ancillary staff in providing education about ileostomy management in the perioperative period, high readmission rates among patients with new ileostomies have persisted. In response to this, many centers have created and implemented perioperative management pathways for patients with new ileostomies to optimize outcomes and reduce readmissions. The Beth Israel Deaconess Medical Center established an ileostomy pathway in 2011. The fundamental components of their pathway include preoperative education, standardized teaching, a critical emphasis on direct patient engagement during the postoperative hospital stay, direct observation of patient's ostomy management, and postdischarge tracking of intake and output with target daily output < 1,200 mL. Interestingly, the study team did not focus on physician education or engagement in the process. The researchers then compared 30-day postdischarge readmission rates for new ileostomates between a postpathway implementation cohort and historical prepathway controls. While the study was nonrandomized, it showed a significant decrease in dehydration-related readmissions from 15.5% in the historical control group to 0% in the postpathway study group. The average length of stay remained stable despite the addition of the intensive inpatient teaching program.²⁹

When treatment is required for persistently high ileostomy output, patients are instructed to avoid meals high in fat and simple sugar content and to increase fiber intake targeting a goal of 20 to 30 g/d. While fiber will increase the thickness of the ileostomy effluent improving symptoms such as leakage and skin irritation, it has little effect on

the total water content of the effluent. If output remains high, pharmacologic treatment is warranted. Loperamide and diphenoxylate are usually used as first-line agents. Additional options include octreotide, codeine phosphate, and tincture of opium, although some are reluctant to use the opioid agents due to their potential for abuse.³

Parastomal Hernia

Parastomal hernia is defined as an incisional hernia that develops through the abdominal wall defect at the stoma site—which many believe as an inevitable consequence of stoma formation.^{4,30} The incidence of clinically significant parastomal hernia with colostomy is reported as high as 39%, while the incidence of asymptomatic parastomal hernia incidentally detected with cross-sectional imaging is nearly 80%.¹⁴ End colostomies have the highest incidence of parastomal hernia. Parastomal hernias are uncommon in the early postoperative period, and while most parastomal hernias occur in the first 2 years after stoma creation, they have been reported to occur up to 10 years after stoma formation. Specific risk factors for parastomal hernia formation are similar to those for stoma prolapse and include obesity, abdominal wall laxity or collagen abnormalities, steroid use, postoperative wound infections or abdominal sepsis, a large fascial opening (>3 cm), and conditions that are associated with increased intra-abdominal pressure such as chronic cough, ascites, or constipation.^{31,32}

While parastomal hernias are frequently asymptomatic, and even when symptomatic often well tolerated, they can be associated with symptoms such as abdominal pain, bowel obstruction, and skin irritation due to difficulties with stoma appliance. Their appearance may be a source of psychosocial stress and embarrassment. These symptoms can have a significant negative impact on patients' quality of life. Obstruction or strangulation of the parastomal hernia contents can be associated with need for reoperation and other life-threatening complications.

There are numerous studies that have investigated techniques that can be used to reduce the incidence of parastomal hernia formation. Preferred size of the stoma aperture has been widely debated. While there is insufficient data to support one ideal size, Hetherington et al have reported that an opening of > 3 cm is associated with a greater incidence of radiologically evident parastomal hernias.³²

It is debated whether stoma location lateral to the rectus muscle is associated with increased risk of parastomal hernia formation. Only one study has convincingly shown a significant benefit to placing stomas through the rectus muscle, while multiple other studies have failed to identify an association between incidence of parastomal hernia formation and stoma position relative to the rectus muscle.^{1,4,33} Even without convincing evidence that stoma placement through the rectus muscle is associated with decreased incidence of parastomal hernia, this technique is still preferred due to its association with superior appliance fit.

Li et al have shown that stoma site specimen extraction is associated with an increased risk of parastomal hernia, but not with need for further surgeries, and this technique is

therefore still a reasonable option in patients requiring temporary stomas.³⁴

Extraperitoneal tunneling, an alternative technique for stoma creation first described by Goligher in 1958, has been shown to be associated with a lower rate of parastomal hernia formation particularly in patients undergoing laparoscopic abdominoperineal resection with end colostomy.^{3,32,35,36} Further prospective randomized studies are needed to better define which subset of patients benefit most from this technique given the increases in operative time and postoperative complications associated with its use.⁴

When symptomatic parastomal hernia requires repair, utilization of mesh during repair is associated with lower recurrence rates than with either local primary fascial repair or stoma relocation alone.^{1,37–39} Accordingly, surgeons have experimented with placement of prophylactic mesh during initial stoma creation in an effort to decrease the incidence of parastomal hernia formation. The results of multiple small studies support the use of prophylactic preperitoneal mesh placement for both ileostomies and colostomies in reducing the incidence of parastomal hernia. Despite concerns about using permanent mesh in the setting of clean-contaminated surgery, mesh-related complications such as erosion, infection, and fistulization were rare.^{40–42} Unfortunately, these studies were limited by small sample sizes, heterogeneous patient populations, and variable-term follow-up.

To further investigate the role of prophylactic retromuscular polypropylene mesh, investigators in the Netherlands designed a multicenter randomized control trial (PREVENT trial) utilizing a standardized technique for mesh incorporation during colostomy formation.⁴³ While early data revealed longer operative times in the study group with no differences in early outcomes after 3 months, there was a significant reduction in the incidence of parastomal hernia at 1 year without differences in morbidity in the mesh group.^{41,44} Researchers in the United Kingdom have designed an alternate method for placement of a retromuscular mesh—a stapled mesh stoma reinforcement technique (SMART).⁴⁵ This open technique thought to lead to minimal increases in operative times utilizes a 28-mm circular stapler preloaded with a 5-cm circular mesh to provide mesh reinforcement to the posterior rectus sheath and peritoneum with a precisely cut stoma trephine. While the SMART technique has data supporting its use in high-risk patients, results from randomized trials including all patients undergoing permanent stoma formation are not yet available.⁴⁶ Other groups have investigated the utility of using prophylactic biologic mesh. While the results are similarly promising, the cost of these biological meshes can be prohibitive and their routine use is not yet justified.⁴⁷

A recent meta-analysis of the PREVENT trial and eight other randomized controlled trials including 569 total participants found a significant decrease in both the odds of developing a parastomal hernia and the odds of requiring surgical repair in the prophylactic mesh group, without evidence of an increase in the odds of surgical or stoma-specific complications. While there were no subgroup effects for mesh position, method for diagnosis of parastomal hernia, or laparoscopic versus open surgery, a subgroup

difference was present for mesh type with only patients receiving a nonabsorbable synthetic mesh having lower odds of developing a parastomal hernia than controls.³⁰ Another recent meta-analysis by Pianka et al corroborated these findings and supported sublay over intraperitoneal mesh position and an open over laparoscopic operative approach.⁴⁸ One study has looked at the efficacy of prophylactic mesh use in the emergency setting and did not identify a significant preventative effect on parastomal hernia formation after 1 year.⁴⁹ There remains limited data on the long-term cost effectiveness of prophylactic mesh use.

While utilization of prophylactic mesh may reduce the incidence of symptomatic parastomal hernia formation in high-risk patients without an unacceptable frequency of mesh-related complications, robust data supporting the routine use of prophylactic mesh in all patients undergoing stoma formation and ideal technique for location of mesh placement is lacking.

Conclusion

Ileostomy and colostomy formations are commonly performed procedures in the United States, but unfortunately they are associated with significant morbidity and stoma-related complication rates reported between 21 and 70%. Preoperative consultation with an enterostomal therapist and stoma site marking by either an enterostomal therapist or experienced surgeon has been shown to reduce postoperative complications. In addition to this, attention to the technical aspects of stoma creation is imperative. Further randomized trials are needed to definitely answer questions about ideal trephine size, utilization of prophylactic mesh, and other facets of stoma construction. Postoperatively, involvement of clinical wound ostomy nurse specialists is invaluable, and the implementation of standardized protocols has further helped mitigate the incidence of common complications and readmissions for dehydration.

Conflict of Interest

None declared.

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